PATENT SPECIFICATION

DRAWINGS ATTACHED

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International Classification: —**B 05 b 1/24**

COMPLETE SPECIFICATION

Improvements in or relating to Melting Solid Materials

We, VIK SUPPLIES LIMITED, a British Company, of Common Road, Stafford, England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method and apparatus for melting polymeric thermoplastic materials, such as hot melt adhesives.

Dispensers for hot melt adhesives are known which comprise a barrel in which the solid adhesive is received and an annular heater surrounding the barrel along its entire length. Owing to the low rate of heat transfer through the solid adhesive, dispensers of this known type are slow to deliver molten adhesive when starting from the cold. For the same reason, there is a risk that the adhesive in the immediate vicinity of the heater may be burnt during the operation of the dispenser.

It is an object of the present invention to provide a method and apparatus for melting polymeric thermoplastic material which do not suffer from the disadvantages mentioned above.

According to the present invention there is provided a method of melting polymeric thermoplastic material, wherein a heater for melting the material is controlled by the pressure of the material upon the heater; such that when the pressure exceeds a given value the heater is heated to a temperature sufficient to melt the material in contact therewith, the molten material hereby produced being induced to pass away from the heater as soon as it has become molten.

The invention also provides apparatus for carrying out this method, comprising means for receiving the thermoplastic material and means for pressing it into contact with the heater which has an operating condition in which its temperature is raised to a level at which thermoplastic material in contact with the heater melts, and a control arrangement for placing the heater in said operating condition while the pressure exerted on the heater exceeds a predetermined value, the arrangement being such that in use material melted in contact with the heater is induced to flow away from the heater as soon as it has been melted.

The heater may take a variety of forms, and, for example, may comprise a series of bars, parallel or otherwise, and of any cross-sectional shape. Alternatively, the heater may take the form of a perforated plate or of a mesh formed by criss-crossing wires or bars, or a bar or tube bent into sinuous form.

A variety of different methods may be employed for supplying the heat. For example, the heater may be heated by conduction from cross-members, which themselves may be heated by any convenient means, such as electrical heating elements or by means of a heated fluid such as hydrocarbon oil or steam. Alternatively, the heater may be heated directly, for example by the circulation of heated fluid or by means of electrical heating elements contained within the heater. As a further alternative, the heater may be constructed as a grid from electrical resistance wire and heated directly in this way, due regard, of course, being paid to the proper insulation of the resistance wire and the remainder of the apparatus.

In a preferred embodiment of the apparatus, the heater is heated by means of an electric heating element, the circuit of which includes a switch device controlled in accordance with the pressure exerted by the thermoplastic material on the heater, the switch device being so arranged that it is in the

"on" position while pressure is maintained against the heater and switches to the "off" position when the pressure is relieved.

The apparatus may take the form of a portable dispenser and the thermoplastic material in the form of a stick or granules may be forced against the heater by any suitable device involving air pressure, hydraulic pressure, a system of mechanical levers or a spring device. The dispenser may comprise a generally tubular container having a heater mounted between the means applying pressure to the material and an applicator nozzle.

Alternatively, in the case where sticks of thermoplastic material are employed, the dispenser may simply comprise one or more struts linking the heater and the means for applying pressure to the stick.

If desired, the container may also be heated by a heater disposed around the container, e.g. a barrel heater, in order to partially melt the thermoplastic material.

The apparatus may be essentially identical in construction to the portable dispenser referred to above except that it is arranged to be attached to a non-portable machine and to apply molten thermoplastic material to articles fed to it.

In use, pressure is applied to the thermoplastic material and is transmitted to the heater which is brought to its operating condition. By virtue of the pressure applied to the thermoplastic material the material contacting the heater melts and a continuous stream of molten material is ejected from the nozzle.

An embodiment of the invention will now be described by way of example only with reference to the accompanying drawings in which:—

Figure 1 is a diagrammatic view partly in section of a portable dispenser in accordance with the invention;

Figure 2 is a diagrammatic view in section on an enlarged scale of the nozzle of the dispenser shown in Figure 1; and

Figure 3 is a plan view of the heater grid.

As shown in the drawings, the portable dispenser comprises a generally tubular housing 10 having a heater 11 mounted at its outlet end and a nozzle 12 disposed on the outlet side of the heater 11. The heater is formed by bending a rod back and forth as shown in Figure 3 and is arranged to be heated directly by passing a heavy current through the rod. As shown, in Figure 1, a rod of solid material such as a hot melt adhesive 13 is placed in the container with its end in contact with the surface 11. The rod 13 is held in contact with the surface 11 by means of a spring loaded plunger 14 which is mounted in the end of housing 10 remote from the heater 11. The force applied by the plunger 14 is controlled by a trigger 21. As shown in Figure 2 the heater 11, nozzle 12 and flexible sealing cone 15, which may be of silicone rubber, are a sliding fit inside the housing 10. Electrical insulators 16 and 17 insulate the heater 11 from the remainder of the dispenser.

A spring loaded switch device 18 is arranged between the housing 10 and the heater 11 and is operated by the pressure exerted by the rod of adhesive 13 on the heater 11. The device 18 comprises a compression spring 19 and a pair of contacts 20. It will be appreciated that so long as the rod exerts a pressure on the heater 11, the contact 20 will remain closed and the current will pass through heater 11. As soon as this pressure is released, spring 19 will open the contacts 20 and the current will be switched off. The switch device, therefore, prevents material being overheated if the pressure of the rod 13 against the heater is released.

The following experiment was carried out to illustrate the high rate at which the dispenser illustrated in the drawing is able to melt thermoplastic adhesive as compared with a conventional hand-held dispenser.

A portable dispenser as described above was loaded with a stick of thermoplastic adhesive of 2" diameter and 6 inches in length and weighing approximately 10 ounces. A current of 100 amperes was passed through the heater at a potential difference of 2 volts, thus generating 200 watts heating effect. After one minute, adhesive began to flow and after 5 or 6 minutes the rod had melted and passed through the gun.

Since the adhesive was raised by approximately 120°C calculation shows that the rate of melting the adhesive is very close to the theoretical maximum that could be obtained by continuous dissipation of 200 watts.

The above performance was compared with that of a conventional dispenser comprising a barrel for reception of the rod of thermoplastic adhesive and having an annular heater surrounding the barrel along its entire length. The dimensions of the dispenser were the same as those of the dispenser in accordance with the invention. The heater had a rating of 500 watts and a thermostat was used to limit the temperature to 250°C since this was the maximum temperaure the adhesive could stand without rapid decomposition.

The heater was switched on and the stick was loaded into the dispenser after it had reached a temperature of 250°C. Several minutes after loading the stick into the dispenser it was possible to produce small amounts of molten adhesive but it generally took 10 to 20 minutes to completely melt the stick and eject it from the gun.

From a comparison of the two performances it is apparent that the dispenser in accordance with the invention produces molten adhesive much quicker than the conventional gun. It should also be noted that in comparing the performances of the two dispensers the con-

ventional unit was timed from the moment the adhesive was loaded into the hot dispenser, while the dispenser in accordance with the invention was timed from the moment when the current was switched on. Due to the mass of the metal used in the construction of the normal type of dispenser it will be appreciated that it could take at least a further 10 minutes to reach a working temperature from the cold. Also the working temperature of 250°C is disadvantageously high and will lead to degradation of many hot melt adhesives.

WHAT WE CLAIM IS:—

1. A method of melting polymeric thermoplastic material, wherein a heater for melting the material is controlled by the pressure of the material upon the heater; such that when the pressure exceeds a given value the heater is heated to a temperature sufficient to melt the material in contact therewith, the molten material thereby produced being induced to pass away from the heater as soon as it has become molten.

2. Apparatus for carrying out the method claimed in claim 1, comprising means for receiving the thermoplastic material and means for pressing it into contact with a heater which has an operating condition in which its temperature is raised to a level at which thermoplastic material in contact with the heater melts, and a control arrangemen for placing the heater in said operating condition while the pressure exerted on the heater exceeds a predetermined value, the arrangement being such that in use material melted in contact with the heater is induced to flow away from the heater as soon as it has been melted.

3. Apparatus for carrying out the method claimed in claim 1, comprising means for receiving the thermoplastic material and means for pressing it into contact with a heater, the heater being capable of being raised, by means of an electric heating element, to a temperature at which thermoplastic material in contact therewith melts, the circuit of said element including a switch device controlled in accordance with the pressure exerted by the thermoplastic material on the heater, the switch-device being so arranged that it is in the "on" position while pressure is maintained against the heater and switches to the "off" position when the pressure is relieved, and means for conducting molten material away from the heater as soon as the material melts.

4. Apparatus according to claim 2 or claim 3, in which the heater is in the form of a plurality of metal tubes or bars heated directly or by conduction from one or more cross-members interconnecting the tubes or bars.

5. Apparatus according to claim 2 or claim 3, in which the heater is in the form of a wire mesh or a plate formed with a number of holes.

6. Apparatus according to claim 2 or claim 3, in which the heater is in the form of a bar or tube bent back and forth.

7. Apparatus according to any one of claims 2 to 6, including means for applying pressure to the thermoplastic material in such a way as to force material melted in the vicinity of the heater through or around the heater and out of the apparatus via an applicator nozzle.

8. Apparatus according to claim 7, in which the means for applying pressure comprises a spring-urged plunger.

9. Apparatus according to claim 7 or claim 8, which comprises a body structure comprising one or more longitudinal struts linking the heater and the means for applying pressure to the thermoplastic material.

10. Apparatus according to claim 7 or claim 8, which includes a generally tubular container for receiving the thermoplastic material.

11. Apparatus according to claim 10, which includes a second heater disposed around the container.

12. Apparatus for melting solid material substantially as described with reference to and as illustrated in the accompanying drawings.

13. A method of melting solid material as claimed in claim 1 substantially as hereinbefore described with reference to the drawings.

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1164446 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

FIG.1.

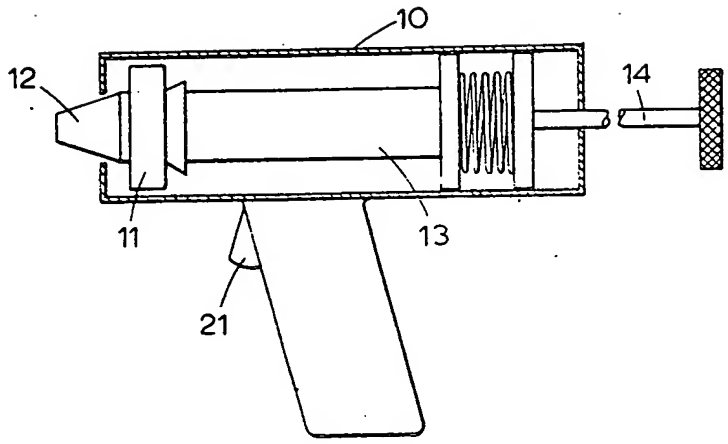

FIG.2.

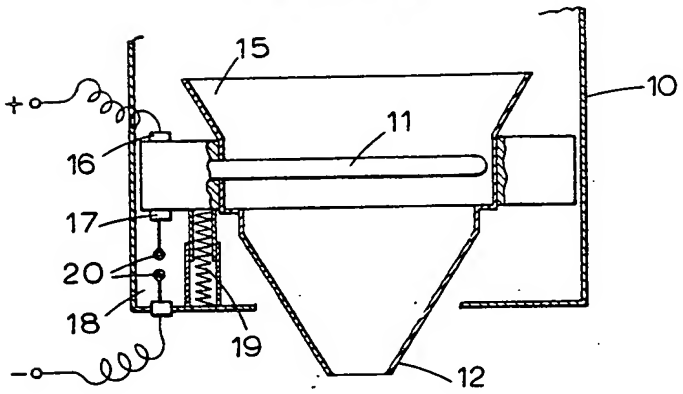

FIG.3.